
# Armed Forces College of Medicine

## AFCM

# Histological structure of small intestine (II)

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# INTENDED LEARNING OBJECTIVES (ILO)

**By the end of this lecture the student will be able to:**

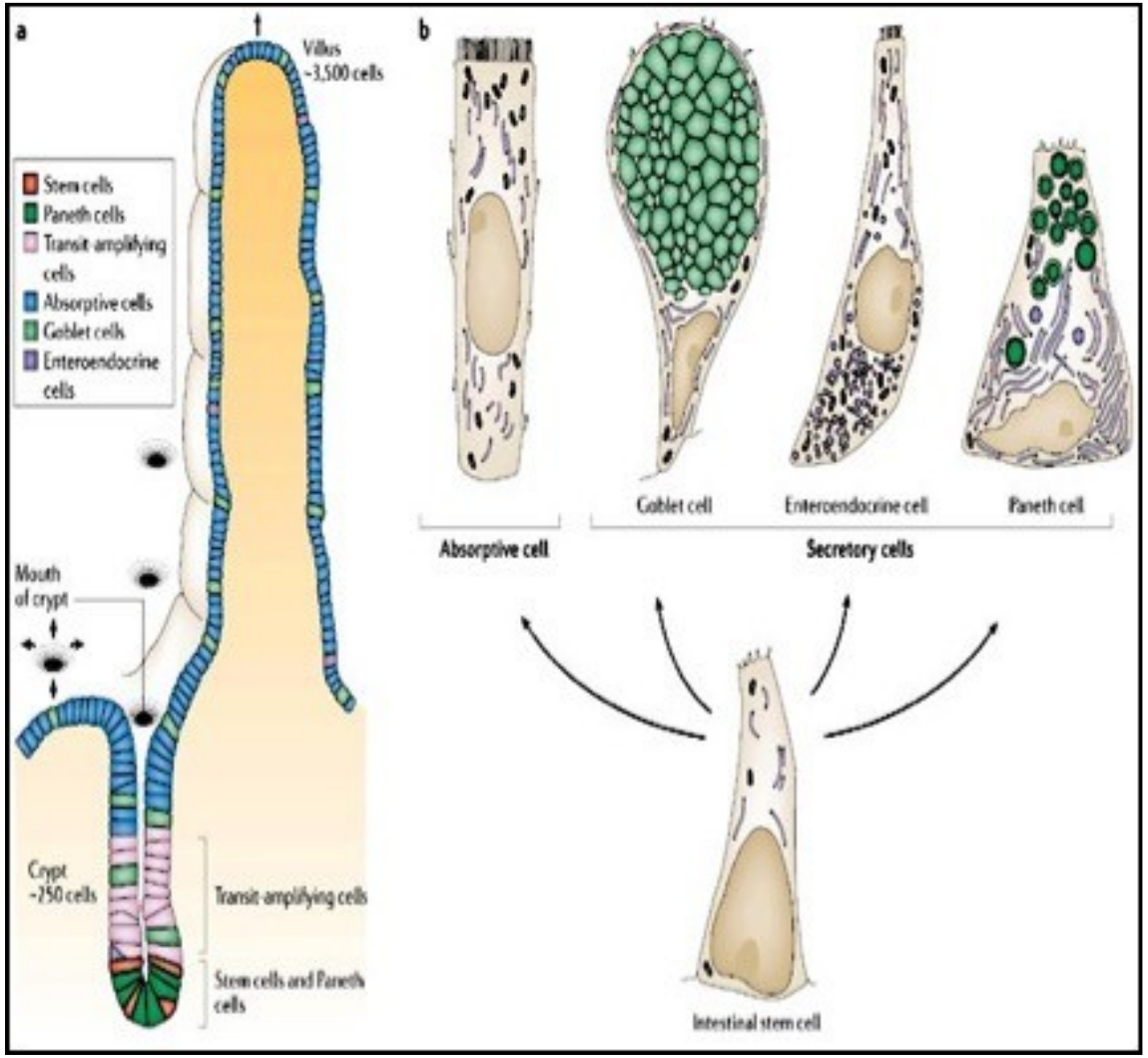
- Describe the structure of cells lining the intestinal crypts
- Correlate the structure of the cells lining the small intestinal crypts to their function.

# Key points of this lecture

Structure of crypt base, Paneth cells and M  cells.
Tracking of M cell defense mechanism.
Unique structure that characterizes the duodenum, jejunum and ileu
How the small intestine structure adapt to its function.

# Epithelial cells lining the intestinal crypts

1- Columnar absorptive cells (Enterocytes).
2- Goblet cells.
3- Enteroendocrine cells.
4- Paneth cells.
5- Crypt base columnar cells (Undifferentiated stem cells).
6- Membrane-like epithelial cells (M Cells).

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# Paneth Cells

- **Site:** Present in groups, at the base of **crypts only**
  [below the stem cells].

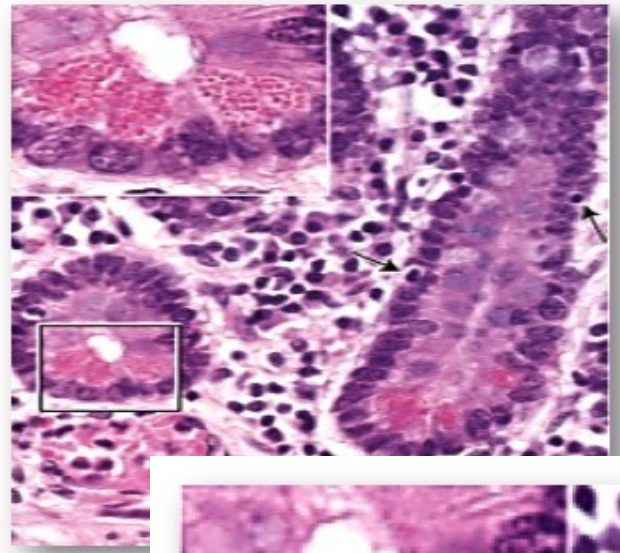
- **LM:** Protein secretory cell .....

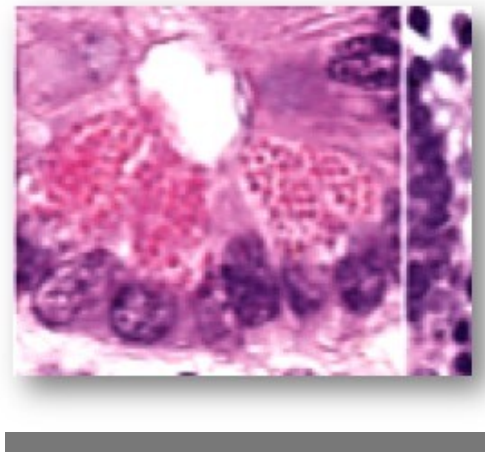
- **EM:** .....

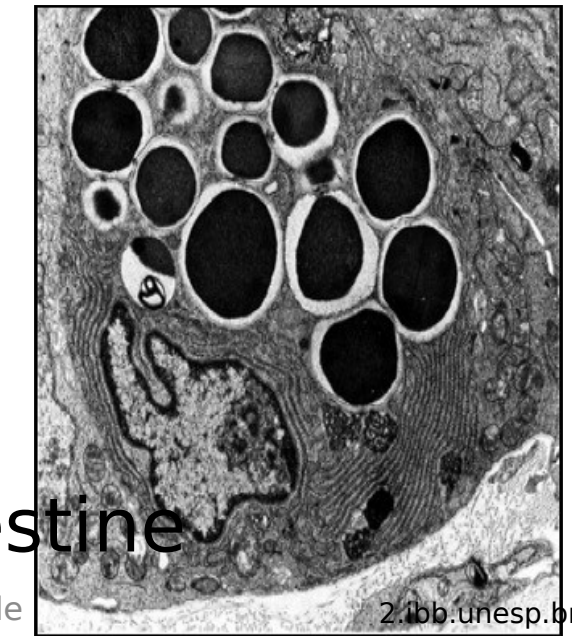
.....

- Secrete:
  - Lysozymes (anti-bacterial).
  - Defensin proteins.

- Regulate the bacteria flora of intestine.







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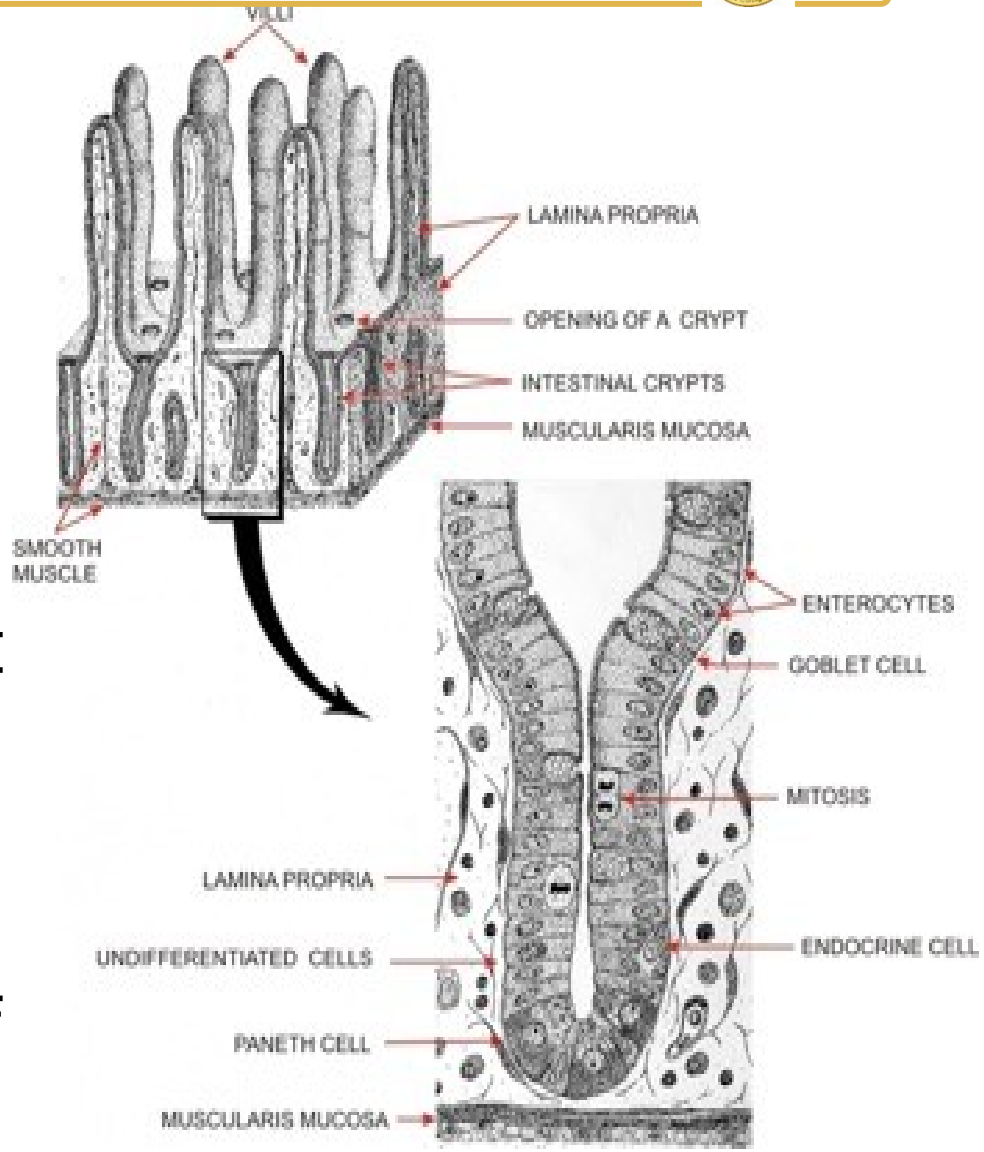
# Crypt base columnar cells

- Stem cells found mainly at the base of the crypts.
- **LM & EM:** ……
- Renewal rate of enterocytes and goblet cells = 4-6 days
- They divide in the crypts and reach the villous surface within one day.
- The epithelial cells migrate to the tip of the villous, then become lost into the intestinal lumen.

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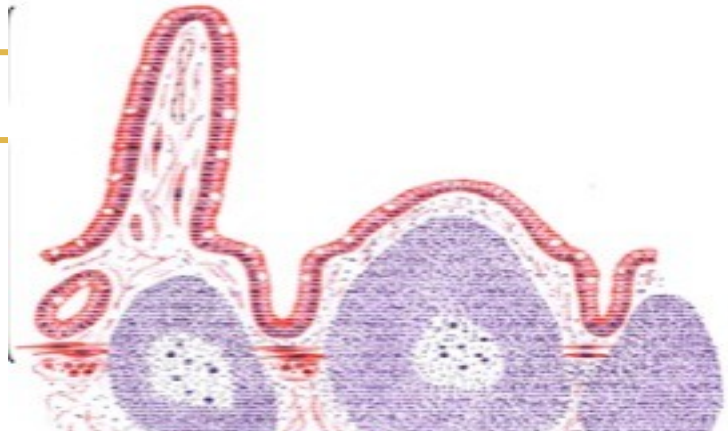
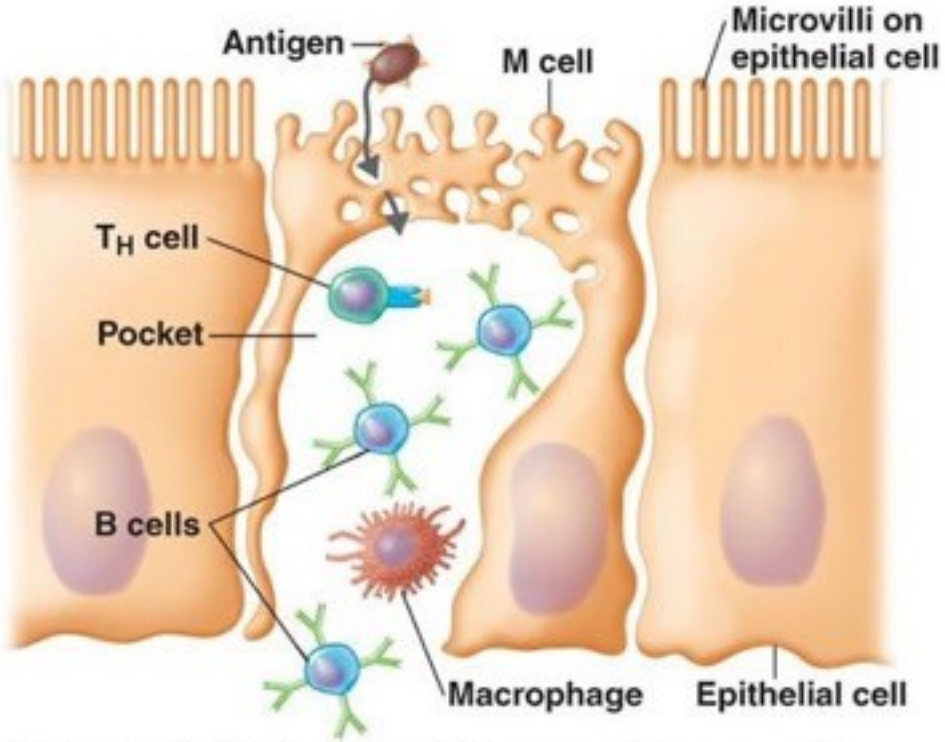


# Microfold Cells (M cells)

- **Site:**

- Between the epith. cells of ileum overlying Peyer's patches.

**L.M.:** Cannot be distinguished because they are very thin & stretched.




**(b) M cells facilitate contact between antigens passing through the intestinal tract and cells of the body's immune system.**

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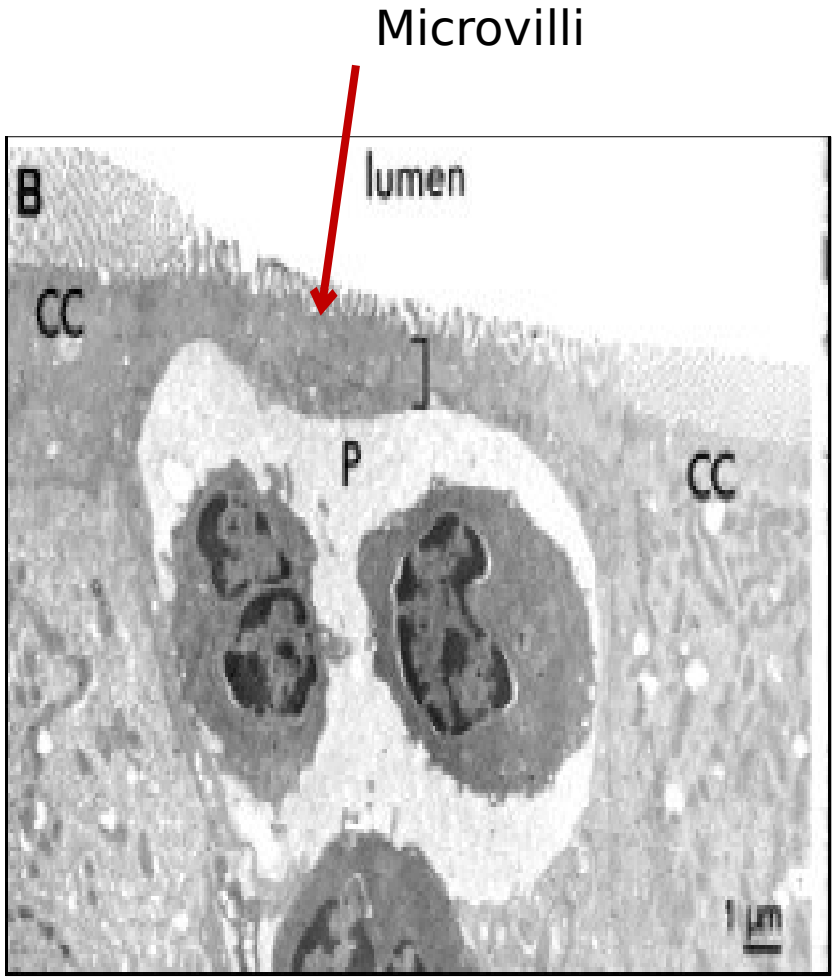
# EM of M cells:

- **Free borders:** Show Small number of **microvilli.**
- **Basal parts:** show numerous basal membrane invaginations, forming **pockets (p)** containing **intraepithelial lymphocytes, dendritic cells & macrophages.**
- **Lateral borders:** joined with the neighboring columnar cells (CC) by

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## *Cells of small intestinal crypts*

# They are **Antigen transporting cell**

They <u>phagocytose</u> antigens

*[from the intestinal lumen]*

↓

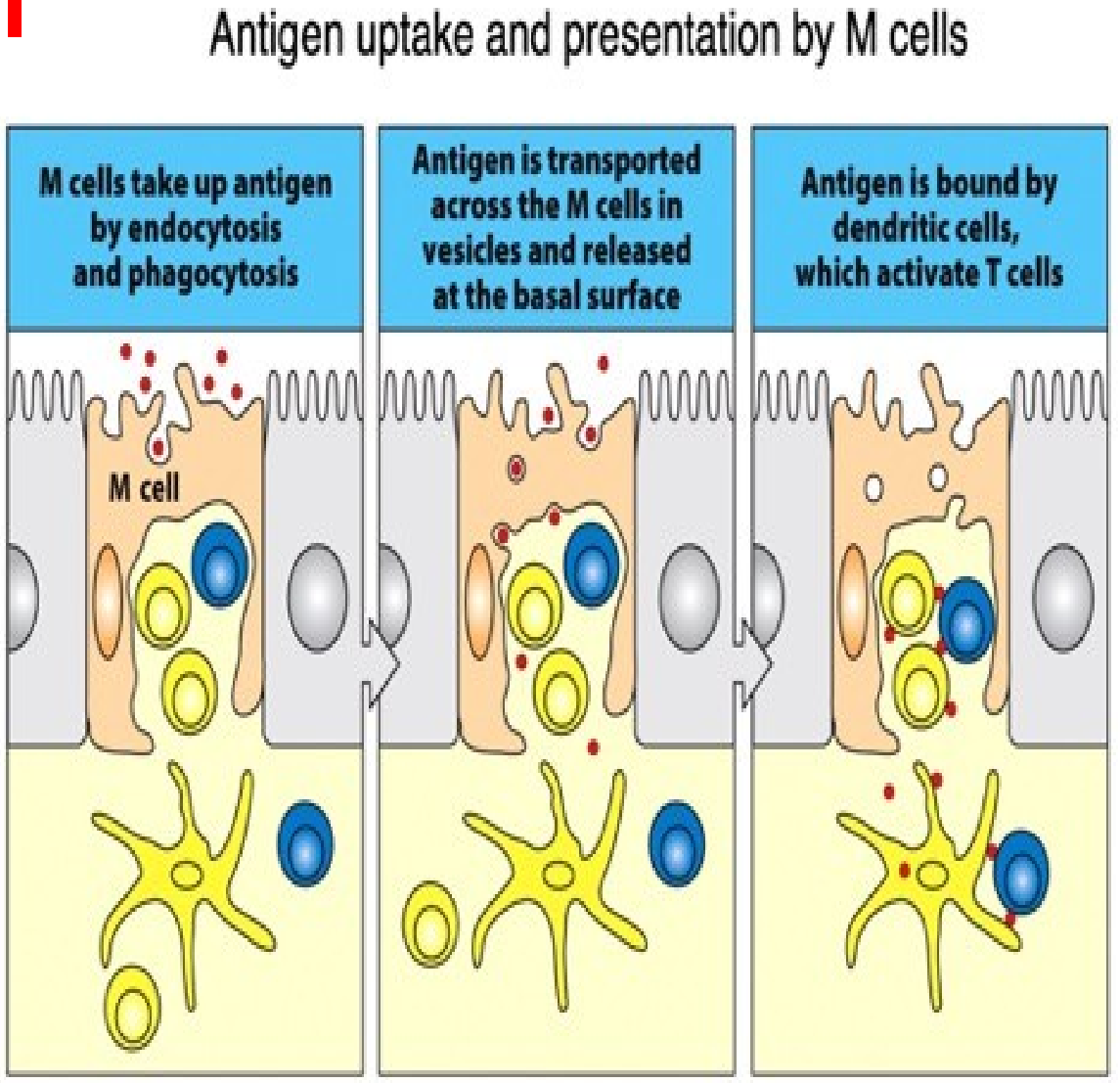
Transports them across the cytoplasm

↓

Antigens bind to the underlying dendritic cells & macrophages to activate the T lymphocytes

↓

These cells migrate to mesenteric lymph nodes to initiate immune response.





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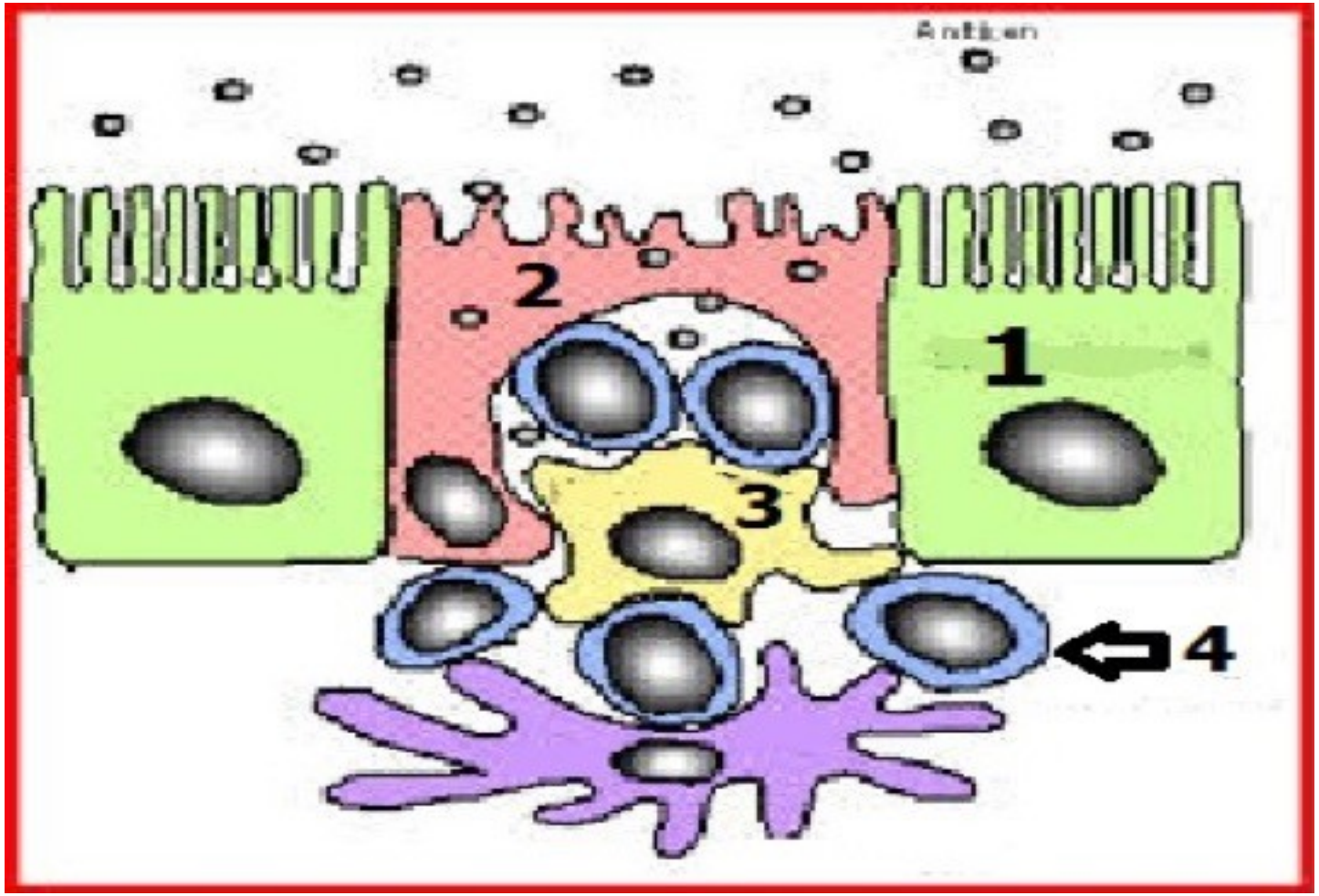
# Lecture quiz

Which of the following uniquely characterizes the structure of the crypt base columnar cells?

a) Basal infoldings.
b) Apical brush border.
c) Numerous diffuse ribosomes.
d) Pocketing of the basal membrane.
e) Basal basophilia with apical acidophilia.

# Lecture quiz

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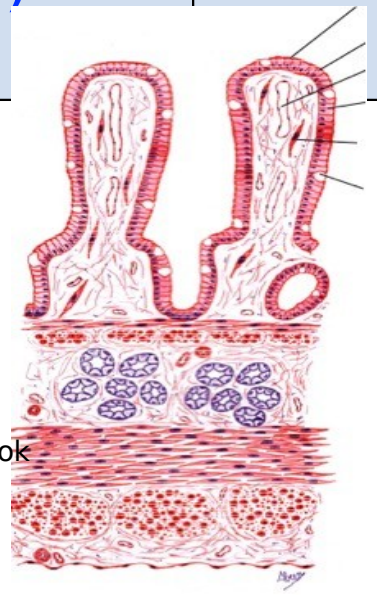
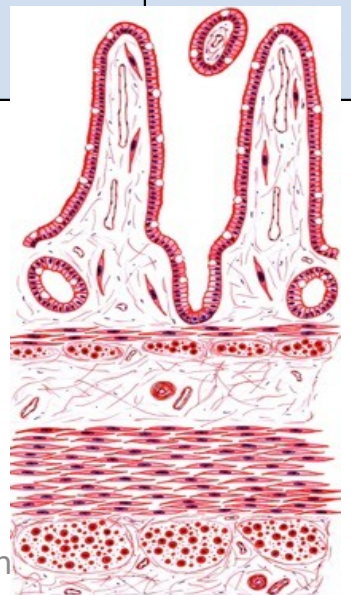
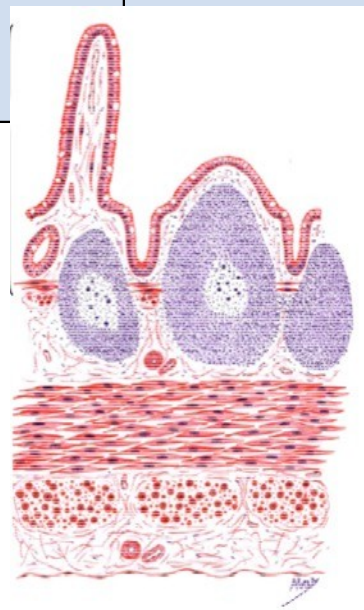
# Histological Differences between different parts of small intestine

| Ileum | Jejunum | Duodenum | |
|---|---|---|---|
| **Least in number** *villi are short or absent over The Peyer's patches* | **Long** | **Broad & numerous** | **Villi** |
| **Numerous** | **More** | **Few** | **Goblet cells** |
| **Peyer's patches** (Immune Surveillance) | **----------** *just c.t. with Meissner's plexus as usual* | **Contains Brunner's glands** | **Submucosa** |







ASU-Histology department book

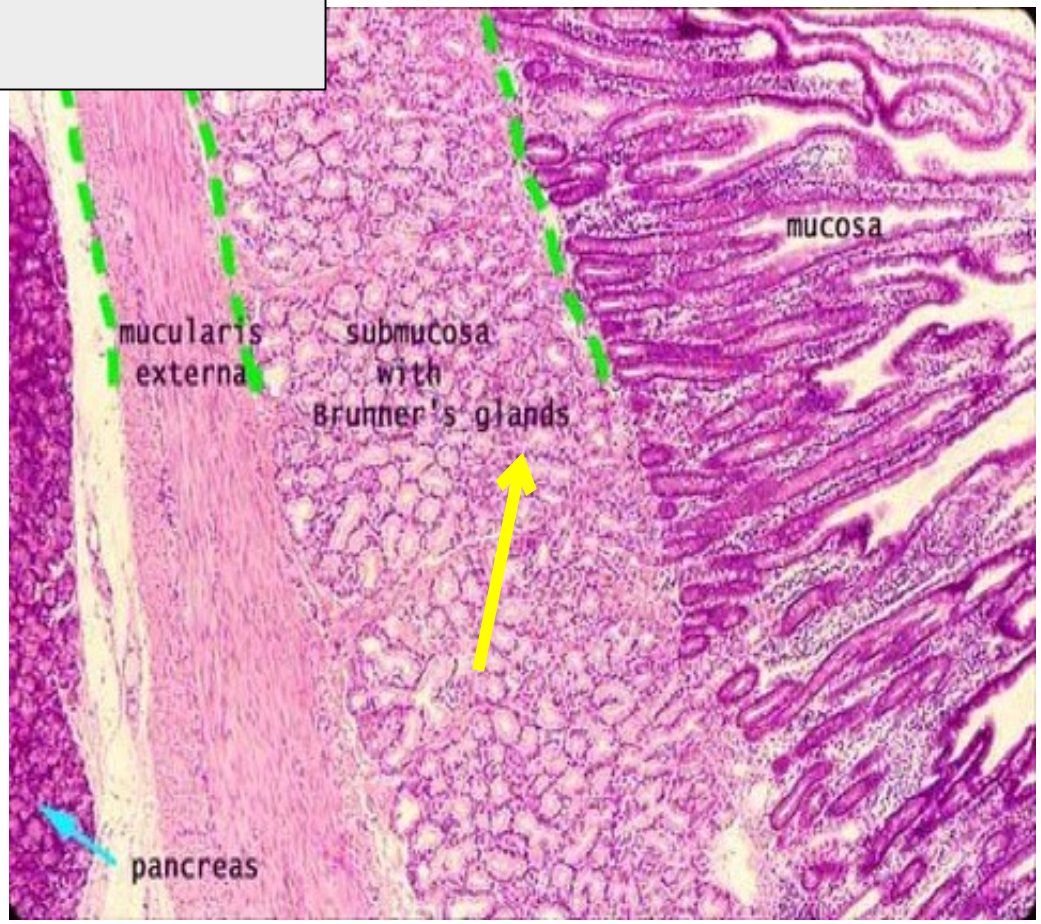
# Brunner's glands of duodenum

They are submucosal mucous acini.

Secrete a **Mucous Alkaline fluid** that:

1) Helps neutralize the acidic chyme thus protecting the duodenal lining.

2) Maintains PH for pancreatic enzymes.

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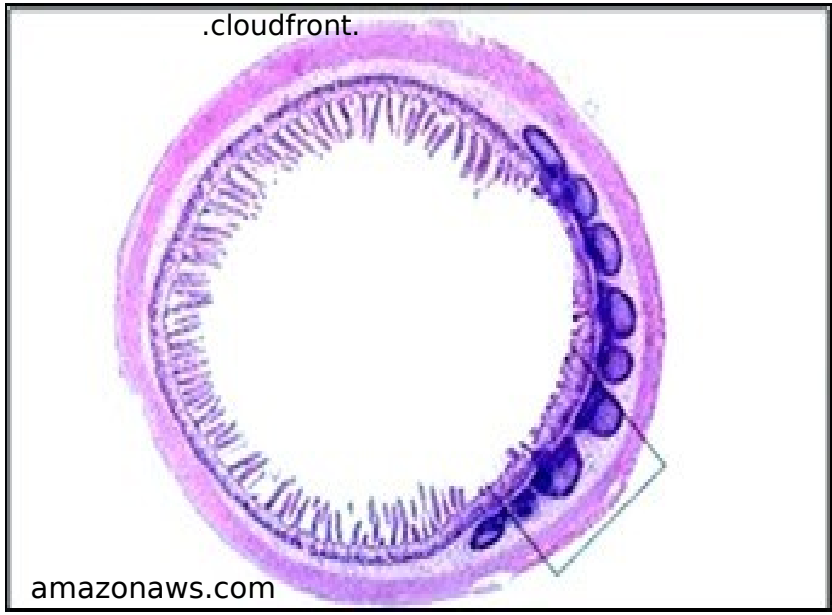
# Peyer's patches of ileum

- Large aggregates of Lymphatic nodules present in the lamina propria & submucosa of ileum.
- Only on the anti-mesenteric border.
- Considered as one of the GALT (immune defense).

- The **villi** over Peyers´ patches are ***short or absent***.

- The epithelial covering of these patches contains **M cells**.



# Structure-function adaptation of small intestine

**A. Increase surface area for absorption:**

a) Intestinal length: 5 meters.
b) Plicae Circulares [Valves of Kerckring].
c) Intestinal villi
d) Microvilli

**B. Brush border of enterocytes :** contain Dipeptidases and disaccharidases

**C. sER in enterocytes:** for re-synthesis of TG during fat absorption process.

**D. Golgi & rER:** for chylomicron production & packaging.

**E. Intestinal Crypts of Lieberkuhn:** secrete enzymes, hormones & mucus.

**F. Submucosal glands:** Mucus-secreting Brunner´s glands in duodenum.

**G. Immunological Function:** M cells & Peyer´s Patches.

# Lecture quiz

**Which of the following features characterizes the lamina propria of the jujenum?**

a)Peyer’s patches.
b)Meissner plexus.
c)Central lacteals.
d)Auerbach plexus
e)Brunner's glands.

# Lecture quiz

*This is a section in the ileum.*

**a)Which border is included in this section?**

**b)The identifying criteria are: ------ & ---------.**

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# Remember the key points of this lecture

Structure of crypt base, Paneth cells and M  cells.
Tracking of M cell defense mechanism.
Unique structure that characterizes the duodenum, jejunum and ileu
How the small intestine structure adapt to its function.

# Summary

## ells of intestinal crypts are:

1- Columnar absorptive cells (Enterocytes).
2- Goblet cells.
3- Enteroendocrine cells.
4- Paneth cells.
5- Undifferentiated stem cells.
6- Membrane-like epithelial cells (M Cells).

The submucosa of **jejunum doesn’t contain glands nor lymphoid patches.**

The **ileum** contain large mucosal and submucosal **Peyer’s patches**.

# Suggested textbooks

1- Junqueira`s Basic Histology; Text and Atlas. 14th edition 2016, pp: 314-317.

2- Histology atlas and test: Michael H. Ross and Wojciech Pawlina, 7th edition, 2015, pp: 572-581


Thank You
Mahalo
Kiitos
Tack
Toda
Grazie
Obrigado
Thanks
Takk
Gracias
Merci